

## CLAIMS

What is claimed is:

1. A process for the compatibilized blending of at least one polymer for a powder coating in a supercritical fluid comprising:
  - forming a homogeneously blended powder coating without fusion or curing of the polymer, including compatibilizing the polymer with additives;
  - dispersing the polymer and additives in a fluid at supercritical conditions of temperature and pressure; and
  - releasing the pressure of the fluid to form the blended powder coating, wherein said compatibilizing is achieved by one of
    - a. preparing graft copolymers having modified functional groups and preferably an average molecular weight of about 3,000 to about 6,000 to increase one of solubility and miscibility in the supercritical fluid;
    - b. selecting a cross-linking agent to increase one of solubility and miscibility in the supercritical fluid;
    - c. controlling starting particle size;
    - d. modifying interfacial properties to promote intraparticle fusion;
    - e. using selective mixing; and
    - f. using controlled depressurization
2. A process according to claim 1 wherein said supercritical fluid is one of carbon dioxide, ethane, ethylene, propane, propylene, nitrous oxide, water, and ammonia.
3. A process according to claim 1, wherein the supercritical fluid is carbon dioxide at supercritical conditions of temperature in a range above the critical temperature (31.4°C) up to about 190°C, and pressure above the critical pressure (72.9 atm).

4. A process according to claim 1, wherein said additives comprise cross-linking agents, ultraviolet absorbers, light stabilizers, hydroxyketones, flow modifiers, silicas, surfactants, pigments, and mixtures thereof.
5. A process according to claim 1 wherein the graft copolymers contain carbonyl functional groups to increase one of solubility and miscibility in the supercritical fluid.
6. A process according to claim 1 including swelling of said blended powder coating, and effecting a semimelt phase of blending and interparticle mass transfer.
7. A process for particle size classifying a powder coating without a grinding stage in a supercritical fluid comprising:
- disposing the powder coating in the supercritical fluid; and
  - separating by one of decreasing the supercritical fluid power/density and decreasing the pressure of the supercritical fluid/powder coating system, wherein said particle size is controlled by one of
    - a. stepwise changes in temperature and pressure of the supercritical fluid comprising:
      - reducing the temperature and pressure of the supercritical fluid but remaining above the supercritical temperature and supercritical pressure;
      - reducing the temperature below the supercritical temperature and dropping the pressure but remaining above the supercritical pressure;
      - reducing the pressure below the supercritical pressure;
    - b. passing the supercritical fluid/powder coating from the blending chamber through an orifice into a striker chamber with a first vertical plate mounted inside the striker chamber in front of the orifice and with a horizontal plate mounted under the vertical plate and with a second vertical plate mounted adjacent to the horizontal plate with the supercritical fluid/powder coating

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impacting on the first vertical plate then the horizontal plate and then on the second vertical plate; and

- c. changing the fluid from supercritical, to subcritical, and then to supercritical, thereby inducing dissolution/swelling precipitation/renewal of said powder coating.

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8. A process according to claim 7 wherein said supercritical fluid is one of carbon dioxide, ethane, ethylene, propane, propylene, nitrous oxide, water, and ammonia.

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9. A process according to claim 7 wherein the supercritical fluid is carbon dioxide at supercritical conditions of temperature in a range above the critical temperature (31.4°C) up to about 190°C, and pressure above the critical pressure (72.9 atm).

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10. A process according to claim 7 wherein said disposing is dissolving said powder coatings in fluids at supercritical conditions of temperature and pressure.

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11. A process according to claim 7 wherein said disposing is swelling said powder coatings in fluids at supercritical conditions of temperature and pressure.

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12. A process according to claim 7 wherein said disposing is blending said powder coatings in fluids at supercritical conditions of temperature and pressure.

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13. A process according to claim 7 wherein changing the fluid phase from supercritical, to subcritical, and then to supercritical is effected by one of changing temperature at constant pressure, changing pressure at constant temperature, and changing temperature and pressure.

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14. A powder coating prepared by the process of encapsulating blending of at least one polymer with additives to form a homogeneously blended powder coating without fusion or curing of the polymers, including

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compatibilizing the polymers, dispersing the polymers in a fluid at supercritical conditions of temperature and pressure, and releasing the pressure of the fluid to form the blended powder coating.

- 5 15. A powder coating of claim 14 wherein the polymer has a polydispersity of about 2 or less.
16. A powder coating of claim 14 wherein said supercritical fluid is one of carbon dioxide, ethane, ethylene, propane, propylene, nitrous oxide,  
10 water, and ammonia.
17. A powder coating of claim 14 wherein the supercritical fluid is carbon dioxide at supercritical conditions of temperature in a range above the critical temperature (31.4°C) up to about 190°C, and pressure above the  
15 critical pressure (72.9 atm).
18. A powder coating according to claim 14, wherein said additives comprise cross-linking agents, ultraviolet absorbers, light stabilizers, hydroxyketones, flow modifiers, silicas, surfactants, pigments, and  
20 mixtures thereof.

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